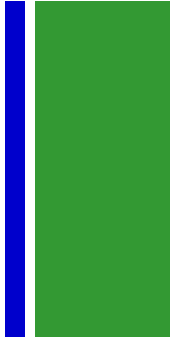


EV Everywhere Charging Infrastructure Roadmap



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- Presenter: Tom Garetson
Electric Applications Inc.
7 June 2016

Project ID – VS172

Overview

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Timeline

- Start date: Sept 2015
- Contract End date: Sept 2016
- > 90% complete

Budget

- Total project funding - \$149,790
- All funding in FY 2016

Barriers

- No barriers to completing roadmap

Partners

- Idaho National Laboratory –
Advanced Vehicle
Technologies Activity

Relevance

Objective: The objective of the Charging Infrastructure Roadmap is to identify and prioritize EV charging infrastructure actions that support the EV Everywhere objective that charging infrastructure should promote PEV adoption and increase electric miles driven without compromising the reliability or performance of the electric grid

Impact: Promoting PEV adoption and promoting the use of charging infrastructure through strategic infrastructure selection and deployment addresses the barriers of vehicle performance and public acceptance of the technology.

Identifying and prioritizing which charging station types, station locations, and deployment timing will maximize the effectiveness of the charging infrastructure's role in promoting PEV adoption and use.

Approach/Strategy

The approach taken to identify and prioritize the next steps for PEV charging infrastructure included:

- Analysis of DOE infrastructure studies
- Apply experience of the authors
- EV Project data
- Input from PEV industry leaders from OEMs, EVSPs, electric utilities, government, and PEV drivers.

Technical Accomplishments and Progress

5

Foundation Developed

- 85% of all charging occurs at home
- When workplace charging is available, only 2% of charging occurs at locations other than home and workplace
- VMT vs eVMT – 9,412 vs 8,668
- Market maturity – utilization of publicly accessible charging infrastructure is associated with the market's PEV population

Technical Accomplishments and Progress

Definitions

Via its EV Everywhere Grand Challenge, three PEV classifications were assumed

- **PEV-40** – Plug-in Hybrid/Electric vehicle with an all-electric range of 40 miles.
- **AEV-100** – All-electric vehicle with a range of about 100 miles
- **AEV-300** – All-electric vehicle with a range of about 300 miles



Image courtesy of autoblog.com



Image courtesy of autoblog.com



Image courtesy of autoblog.com

These PEVs have differing charging infrastructure needs.



Image courtesy of autoblog.com



Image courtesy of autoblog.com



Image courtesy of autoblog.com

Technical Accomplishments and Progress

Definitions

Charging infrastructure definitions will also be necessary to frame the roadmap. They consist of 2 important charging station characteristics; *rate of charge & station location*.

- **Rate of Charge**

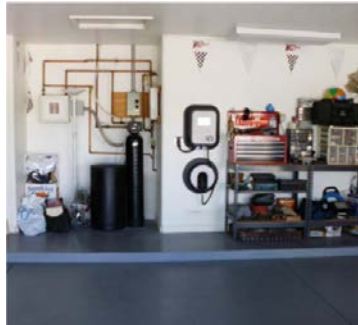
- **AC Level 1** – typically has charge rate of less than 2.0 kW (ACL1)
- **AC Level 2** – typically has charge rates from 3.0 kW to 10 kW (ACL2)
- **DC Fast Charger** – typically has charge rates greater than 10 kW up to 90 kW (DCFC)

Technical Accomplishments and Progress

Definitions

- **Location**

- **Residential** – parking location for overnight charging (ACL1 or ACL2), (aka at-home charging)



- **Workplace** – away from home charging during the workday, typically providing a full charge (ACL1 or ACL2)



Technical Accomplishments and Progress

Definitions

- **Location**

- **Publicly Accessible** – away from home charging that is convenient to travel destinations and activities other than work, more often providing a partial recharge (ACL2)



- **Intra-urban fast charging** – convenient fast charging within an urban area (DCFC)
- **Inter-urban fast charging** – DCFC charging located between urban centers, and intended to provide all-electric travel between the urban centers (DCFC)



Technical Accomplishments and Progress

Definitions

In addition to defining the PEV and charging hardware terms, we also noted that both the PEV & charging infrastructure are at different phases.

- **Early Stage** – PEV adoption by early adopters & enthusiasts. Little away from home infrastructure in place. PEV adoption and use are not dependent upon away from home charging.
- **Transitional** – Density of deployed away from home charging infrastructure increases with growing utilization of away-from-home charging, which is primarily workplace and fast-charging.
- **Mature** – Pervasive away-from-home infrastructure provides convenience and inter-urban charging. Charging energy needs of the majority of newer PEV drivers is met primarily with at home charging.

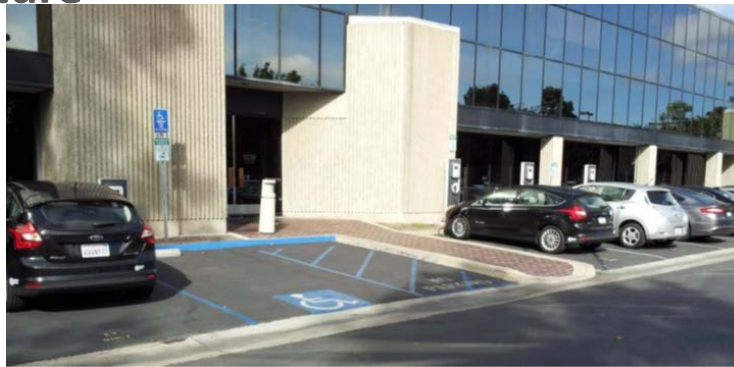
... and as the market grows and moves through these phases, the increasing quantity of deployed charging infrastructure enables the different vehicle classifications at different times.

Technical Accomplishments and Progress

Phase	PEV-40	AEV-100	AEV-300
Early Stage	Residential AC L1	Residential AC L2	Residential AC L2
Transitional	Workplace AC L2	Workplace AC L2	Publicly Accessible DC
Mature	Publicly Accessible AC L2	Intra-Urban DC	Publicly Accessible DC

Technical Accomplishments and Progress

- Home Charging is and will be, the primary PEV charging location
- Workplace charging is the second most important
- Intra-urban DC Fast charging is the preferred means of restoring transportation flexibility that comes from a charged battery
- As the vehicle market matures to more AEV-300's, it reinforces home as the most important charging location, and is really the only reliable customer for inter-urban charging infrastructure



Collaboration and Coordination with Other Institutions

- **Idaho National Laboratory**
 - Extensive analysis of multiple PEV charging infrastructure studies
 - Published reports on PEV infrastructure utilization
- **PEV industry experts from vehicle OEMs, electric utilities, EV Service Providers, and EV enthusiasts.**

Remaining Activities

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- Final editing and incorporating reviewer comments into the roadmap document

Proposed Future Work

(work that will support the roadmap)

- Continue to promote and support workplace charging as an important way to enable electric miles
- Retain, extend and expand financial incentives to invest in charging infrastructure
- Simplify, as so many jurisdictions already have, the permitting process for EVSE
- Promote the adoption of building codes which require all new construction include accommodation for charging stations
- Promote Green building credits for EV infrastructure
- Encourage electric utility commissions to adopt EV charging and TOU rates

Summary Slide

- The EV Everywhere Charging Infrastructure Roadmap identifies the what, where, and when
- People use personal transportation to meet their personal transportation needs, regardless of vehicle and fueling technology employed
- Current PEV owners/drivers meet over 90% of their electric miles needs with home charging and/or workplace charging, which should be the focus of infrastructure actions
- As vehicle systems technologies continue to develop, becoming more efficient and extending their range, charging at home will meet even more of the transportation needs.

Summary Slide

- Ongoing support is required to -
 - Continue to raise public awareness
 - Continue to promote workplace charging
 - Maintain and expand financial incentives for charging infrastructure deployment
 - Building codes should require that charging infrastructure be accommodated in all new construction (commercial and residential)
 - Encourage electric utilities to offer special EV rates